

JAMES WALKER CROW

Curriculum Vitae

Personal Information

James W. Crow, Ph.D.

EDUCATION

- 1965 **Bachelor of Science in Mathematics**; Millsaps College, Jackson, MS.
- 1967 **Graduate Studies in Computer Science**; University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
- 1971 **Doctor of Philosophy (Pharmacology)**; University of Mississippi Medical Center, Jackson, MS.
- 1976 **Post-Doctoral Fellow**; Clinical Pharmacology; Sponsor: Daniel Azarnoff, M.D., University of Kansas Medical Center, Kansas City, KS.
- 1978 **NIH Post-Doctoral Fellow**; Pharmacokinetics; Sponsors: Gerhard Levy, Pharm.D. and Milo Gibaldi, Ph.D., School of Pharmacy, State University of New York at Buffalo, Buffalo, NY.

ACADEMIC APPOINTMENTS

- 1967 **Teaching Assistant**, Department of Computer Science and Department of Mathematics, University of North Carolina at Chapel Hill, Chapel Hill, NC.
- 1968 **Instructor**, Computer Programming, Summer Session, Millsaps College, Jackson, MS.
- 1973 **Instructor**, Department of Pharmacology, University of Kansas Medical Center, Kansas City, KS.
- 1975 **Assistant Professor**, Department of Pharmacology, University of Kansas Medical Center, Kansas City, KS.
- 1976 **Post-Doctoral Fellow**; Clinical Pharmacology, University of Kansas Medical Center, Kansas City, KS.
- 1978 **NIH Post-Doctoral Fellow**; Pharmacokinetics, School of Pharmacy, University of New York at Buffalo, Buffalo, NY.
- 1988 **Adjunct Assistant Professor**, School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill, NC.
- 2009 **Adjunct Associate Professor**, School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill, NC.
- 2009 **Board of Visitors**, School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill, NC.

PROFESSIONAL APPOINTMENTS AND ACTIVITIES

- 1980 **Clinical Research Scientist II**, Clinical Pharmacology/Pharmacokinetics Section, Clinical Research Division, Wellcome Research Laboratories, Burroughs Wellcome Co., Research Triangle Park, NC.

- 1983 **Senior Clinical Research Scientist I, Acting Section Head**, Clinical Pharmacology/
Pharmacokinetics Section, Clinical Research Division Wellcome Research Laboratories,
Burroughs Wellcome Co., Research, Triangle Park, NC.
- 1990 **Section Head**, Hematology/Inflammation Section (previously Clinical Pharmacology/
Pharmacokinetics Section), Clinical Research Division, Wellcome Research Laboratories,
Burroughs Wellcome Co., Research Triangle Park, NC.
- 1995 **Director**, Cardiopulmonary II Section, Clinical Research Division, Wellcome Research
Laboratories, Burroughs Wellcome Co., Research Triangle Park, NC.
- 1996 **Director of Clinical Research**, Cato Research, Research Triangle Park, NC
- 2002 **Co-Founder, President, Chief Operating Officer**, United Therapeutics, Research Triangle
Park, NC and Silver Springs, MD (NASDAQ listing: UTHR).
- 2009 **President, CEO**, James Walker Crow, Consulting, Chapel Hill, NC.

OTHER APPOINTMENTS

- 1992-1997 **Scientific Advisory Board**, United Patients' Association for Pulmonary Hypertension
(Pulmonary Hypertension Association)
- 1995 **Member, Scientific Advisory Board**, Orphan Use of Flolan in Primary Pulmonary
Hypertension, Burroughs Wellcome Co. and Glaxo-Wellcome.

PROFESSIONAL ORGANIZATIONS/SOCIETIES

American Society for Clinical Pharmacology and Therapeutics (ASCP&T)
 Publications Committee: ASCP&T (1986-1987)
 American Pharmaceutical Association (APhA)
 Association for Computing Machinery (ACM)
 International Society for Quantum Biology
 Quantum Chemistry Program Exchange, University of Indiana
 American Chemical Society (Division of Medicinal Chemistry)
 Publications Committee: Journal of Medicinal Chemistry (1972)
 Publications Committee: Journal of Clinical Pharmacology and Therapeutics (1986)

MANAGEMENT EXPERIENCE

- 1981 **Project Leader**: Directed and led an across-divisional project to assess the potential use of
tetra-hydrocannabinoids in treatment of patients with glaucoma; Burroughs Wellcome Co.
Research Triangle Park, NC.
- 1995 **International Project Leader**: Directed and led a multinational across-divisional project to
develop epoprostenol (prostacyclin) as a treatment for patients with kidney failure, pulmonary
arterial hypertension, and congestive heart failure.
- 1983 **Acting Section Head**: Clinical Pharmacology/Pharmacokinetics Section, Clinical Research
Division, Burroughs Wellcome Co., Research Triangle Park, NC.

- 1990 Section Head:** Hematology/Inflammation Section (previously Clinical Pharmacology and Pharmacokinetics Section), Clinical Research Division, Burroughs Wellcome Co., Research Triangle Park, NC.
- 1989 Project Leader:** Directed and led an across-divisional project to assess the potential usefulness of a compound for room temperature preservation and storage of red cells.
- 1983 Project Leader:** Directed and led an across-divisional project to assess the use of a structural analogue of epoprostenol in adult patients with respiratory distress syndrome.
- 1995 Director:** Cardiopulmonary II Section, Clinical Research Division, Burroughs Wellcome Co., Research Triangle Park, NC.
- 1996 Director:** Clinical Research, Cato Research, Research Triangle Park, NC
- 1996-2002 Co-Founder, President, Chief Operating Officer:** United Therapeutics, Research Triangle Park, NC and Silver Springs, MD. (NASDAQ listing: UTHR). Led with CEO all activities resulting in the successful initial public offering of United Therapeutic, Inc. Remodulin (treprostenol sodium, UT-15): lead in-licensing efforts to secure all rights for all indications from Glaxo-Wellcome Co. and The Upjohn Company; directed and led all across-divisional project activities for the multinational development and marketing registrations/approvals.
- 2013 Co-Founder, Chief Executive Officer:** ACRIS Pharmaceutical, LLC.

PATENTS

1. Tadepalli, A.S., Long, W.A., **Crow, J.W.**, Klein, K.B.: U.S. Patent Application #JL/87/B. 533/38942, "Use of benzidine prostaglandins in pulmonary hypertension."
2. Tadepalli, A.S., Long, W.A., **Crow, J.W.**, Klein, K.B., Whittle, B.J.R.: European Patent Application #89306121.8, "Compounds for use in medicine."
3. **Crow, J.W.**, Long, W.A.: "Treatment of Congestive Heart Failure." May 23, 1991, Doc. No. 41045.
4. Long, W.A., **Crow, J.W.**: "Novel Use for Compounds in Medicine." May 23, 1991, Doc. No. 41046.
5. Tadepalli, A.S., Long, W.A., **Crow, J.W.**, Klein, K.B. "Method of treating pulmonary Hypertension with benzidine prostaglandins." U.S. Patent 5,153,222 , Oct. 6, 1992; APPL 71 5,439.
6. **Crow, J.W.**, Blackburn, S.D., Roscigno, R., Wade, M, Cloutier, G., Rothblatt, M. "Use of 9-Deoxy-2',9-alpha-methano-3-oxa-4,5,6-trinor-3,7-(1',3'-interphenylene)-13, 14-dihydro-prostaglandin F₁" U.S. Patent 6,054,486, Apr 25, 2000.

DRUG DEVELOPMENT EXPERIENCE

Orphan Status Applications

- 1980** Replacement of heparin with Flolan during hemodialysis of patients at risk of hemorrhage.
- 1984** Treatment of Primary Pulmonary Hypertension with Flolan (epoprostenol, PGI₂, PGX).
- 1997** Treatment of Primary Pulmonary Hypertension with BW 15AU (structural analogue of epoprostenol).

Subpart E Designations

- 1991** Treatment of Primary Pulmonary Hypertension with Flolan (epoprostenol, PGI₂, PGX).
- 1998** Treatment of Primary Pulmonary Hypertension with BW 15AU (structural analogue of epoprostenol).

In-licensing of Pharmaceutical Products

- 1996-** Led in-licensing efforts to secure all rights form Glaxo-Wellcome Co. and The Upjohn
- 1997** Company for the full development of Remodulin (treprostenol) for all indications.

INDs

- 1980** BW 91Y (structural analogue of tetra-hydro-cannabinoid) as an oral treatment for patients with glaucoma. A-IND: Use of BW 91Y as an oral anti-emetic in treating cancer patients undergoing chemotherapy.
- 1981** Use of Flolan (epoprostenol sodium) instead of heparin during hemodialysis of patients at increased risk of hemorrhage, A-IND: Use of Flolan in treating new-born infants with PPHN. A-IND: Use of continuous intravenous infusion of Flolan in treating patients with primary pulmonary hypertension.
- 1984** Use of BW 245C as an intravenous treatment in patients with pulmonary hypertension and COPD.
- 1991** Use of Flolan as a continuous intravenous infusion in treating patients with CHF.
- 1991** Use of BW 15AU as a continuous intravenous infusion to treat patients with CHF.
- 1996** Use of Remodulin (treprostenol sodium, UT-15) as a continuous subcutaneous infusion to treat patients with pulmonary arterial hypertension. Identified and utilized contract companies/organizations for chemical synthesis and analytical, formulation and labeling support; identified and utilized consultants for preclinical pharmacology, toxicology and pharmacokinetic support; developed and utilized in-house expertise for the clinical, statistical and regulatory activities.

International equivalent filings of INDs

- 1997** UK, Netherlands, Sweden, France, Spain, Australia, Austria, Poland, Belgium, Italy, Israel, Mexico, Canada: Use of UT-15 as a continuous subcutaneous infusion to treat patients with pulmonary arterial hypertension.

NDA's Filed

- 1985** FLOLAN as replacement for heparin during hemodialysis in patients at risk of hemorrhage.
- 1986** FLOLAN for the diagnosis of vasoreactivity in patients with primary pulmonary hypertension.
- 1993** FLOLAN for the treatment of patients with primary pulmonary hypertension.

1999 Remodulin (treprostenol, UT-15) for treatment of patients with pulmonary arterial hypertension.

Advisory Committee Presentations/Defense

1995 Flolan for treatment of patients with primary pulmonary hypertension

2001 Remodulin for treatment of patients with pulmonary arterial hypertension

NDA's Approved

1995 FLOLAN for the treatment of patients with primary pulmonary hypertension.

2002 Remodulin (treprostenol sodium, UT-15) for treatment of patients with pulmonary arterial hypertension.

Drug Delivery Technology

1984 Co-identified the technology for chronic out-patient intravenous infusion of potent vasoactive compounds in critically ill patients with pulmonary hypertension.

1987 Co-identified a follow-up compound (BW-15AU) of FLOLAN which is a chemically stable structural analogue of epoprostenol with an extended half-life.

1987 Sponsored efforts with Alza Laboratories to develop a controllable transdermal iontophoretic delivery of UT-15.

Grants Funded

1976-1978 **NIH Grant:** The effect of phenobarbital-like compounds on the systemic availability of orally administered, poorly water soluble compounds.

1978 **Burroughs Wellcome Co. Grant:** The underlying mechanism of reduced systemic availability of poorly water soluble compounds by phenobarbital-like agents.

CORPORATE MANAGEMENT EXPERIENCE

1990-1995 Director: Cardiopulmonary Section II, Clinical Research Division, Burroughs Wellcome Co.

1995-1996 Director: Clinical Research, Cato Research

1996 Co-Founder: Lung Rx (now owned by United Therapeutics, Inc.)

1996 Co-Founder: United Therapeutics, Inc.

1996-2002 President and Chief Operating Officer: United Therapeutics, Inc.

1996-2002 Board Member: United Therapeutics, Inc.

1997 President and Chief Operating Officer: Initial Public Offering: United Therapeutics, Inc. (NASDAQ listing: UTHR)

BIBLIOGRAPHY

Publications: Refereed Journals

1. **Crow, James**, Otmar Wasserman and William C. Holland. Molecular orbital calculations on a new series of substituted-phenyl choline ethers. *J. Med. Chem.* 12 (5):764-6, 1969.
2. Pfaffman, M.A., S.A. McFarland and **J.W. Crow**. The effects of caffeine on the contractile activity of taenia coli. *Arch. Int. Pharmacodyn. Therap.* 191(1): 5-14, 1971.
3. **Crow, James W.** and William C. Holland. Molecular orbital calculations on the preferred conformation of neostigmine. *J. Med Chem.* 15(4): 429, 1972.
4. **Crow, James W.** Molecular orbital calculations on the preferred conformation of futrethonium. *J. Med. Chem.* 16:728, 1973.
5. Huffman, David H., **James W. Crow**, Pertti Pentikainen and Daniel L. Azarnoff. Association between clinical cardiac status, laboratory parameters and digoxin usage. *Am. Hear J.* 91(1): 28-34, 1976.
6. **Crow, James W.**, F.Bochner, P. Lain, D.W. Shoeman and D.L. Azarnoff. Effect on steady-state glutethimide and hydroxyglutethimide levels on performance of a tracking test. *Pharmacologist* 18:199, 1976.
7. **Crow, James W.**, Pedro Lain, Felix Bochner, D.W. Shoeman and D.L. Azarnoff. Glutethimide and 4-OH glutethimide: Pharmacokinetics and effect on human performance. *Clin. Pharmacol. Ther.* 22(4):458-64, 1977.
8. **Crow, James W.** and Milo Gibaldi. Estimations of pharmacokinetic parameters at steady-state in patients. *Drug Intell. Clin. Phar.* (612-616), 1978.
9. **Crow, James W.** and Gerhard Levy. Use of a programmable calculator to determine steady-state levels of drugs eliminated by parallel first-order and Michaelis-Menten kinetics. *Am. J. Hosp. Pharm.* 35(9):1075-7, 1978.
10. **Crow, James W.**, Milo Gibaldi, and Gerhard Levy. Comparative pharmacokinetics of coumarin anticoagulants LXI: Effect of Phenobarbital on systemic availability of orally administered dicumarol in rats. *J. Pharm. Sci.* 68: 958, 1979.
11. **Crow, James W.**, Milo Gibaldi, and Gerhard Levy. Comparative pharmacokinetics of coumarin anticoagulants XLII: Effect of Phenobarbital on the systemic availability of orally administered dicumarol in rats with ligated bile ducts. *J. Pharm. Sci.* 68(10):1309-12, 1979.
12. Cocchetto, David M., William A. Wargin and **James W. Crow**. Pitfalls and valid approaches to pharmacokinetic analysis of mean concentration data following intravenous administration. *J. Pharmacokin. Biopharm.* 8:539-552, 1980.
13. Tiedeman, James S., M Bruce Shields, Paul A. Weber, **James W. Crow**, David M. Cocchetto, William A Harris and John F. Howes. Effect of synthetic cannabinoids on elevated intraocular pressure. *Ophthalmology* 88(3):270-277, 1981.
14. Zusman, Randall M., Robert H. Rubin, Allen E. Cato, David M. Cocchetto, **James W. Crow** and Nina Tolkoff-Rubin. Hemodialysis using prostacyclin instead of heparin as the sole antithrombotic agent. *New Eng. J. Med.* 304(16): 934, April 16, 1981.
15. Zusman, Randall, M., **James W. Crow**, Allen E. Cato and Nina Tolkoff-Rubin. Effects of prostacyclin infusions in uremic patients: Hematologic and hemodynamic responses. *Clin. Pharmacol. Ther.* 30(2):251-7, 1981.

16. Smith, M.C., K. Danviriyasup, **J.W. Crow**, A.E. Cato, G.D. Park, A. Hassid, M.J. Dunn. Prostacyclin substitution for heparin in long-term hemodialysis. *Am J. Med.* 73: 669-78, 1982.
17. Miller, L.C., J.C. Hall, **J.W. Crow**, et al. Hemodialysis in heparin-associated thrombocytopenia: Epoprostenol (PGI₂) as sole anticoagulant. *Dialysis Transplant* (579-580) 1985.
18. Swartz, R.D., W. Flamenbaum., A. Dubrow, J. Hall, **J.W. Crow**, A.E. Cato. Epoprostenol (PGI₂, Prostacyclin) during high-risk hemodialysis: preventing further bleeding complications. *Clin. Pharmacol.* 28(9):818-25, 1988.
19. Rubin, L.J., J. Mendoza, M. Hood, M. McGoon, R. Barst, W.B. Williams, J.H. Diehl, **J. Crow**, and W. Long. Treatment of primary pulmonary hypertension with continuous intravenous prostacyclin: Results of a Randomized Trial. *Ann. Internal Med.* 112:485-491, 1990.
20. Palevsky, H.I., W.A. Long, **J.W. Crow**, and A.P. Fishman. Prostacyclin and acetylcholine as screening agents for acute pulmonary vasodilator responsiveness in primary pulmonary hypertension. *Circulation* 82(6):2018-26, 1990.
21. Caruana, R.J., M.C. Smith, D. Clyne, **J.W. Crow**, J.M. Zinn, J.H. Diehl. Controlled study of Heparin versus Epoprostenol Sodium (prostacyclin) as the sole anticoagulant for chronic hemodialysis. *Blood Purification* 9(5-6):296-304, 1991.
22. Barst, R.J., L.J. Ruben, W.A. Long, M.D. McGoon, S. Rich, D.B. Badesch, B.M. Groves, V.F. Tapson, R.C. Bourge, B.H. Brundage, S.K. Koerner, D. Langleben, C.A. Keller, S. Murali, B.F. Urtesky, L.M. Clayton, M. m. Josis, S.B. Blackburn, D. Shortino, **J.W. Crow**, Primary Pulmonary Hypertension Study Group. Continuous Intravenous prostacyclin versus conventional therapy in primary pulmonary hypertension. *New Eng. J. Med.* 334: 296-301, 1996.
23. Archer, S.L., D. Miho, **J. Crow**, W. Long, E.K. Weir. A placebo controlled trial of prostacyclin (PGI₂) in Acute Respiratory Failure complicating chronic obstructive lung disease (COPD). *Chest* 109(3):750-5, 1996.
24. Hinderliter, A.L., P.W. Willis, R.J. Barst, S. Rich, L.J. Rubin, D.B. Badesch, B.M. Groves, M.D. McGoon, V.F. Tapson, R.C. Bourge, B.H. Brundage, S.K. Koerner, D. Langleben, C.A. Keller, S. Murali, B.F. Uretsky, G. Koch, S. Li, W.A. Long, L.M. Clayton, M.M. Jobsis, S.D. Blackburn, **J.W. Crow**. Effects of long-term infusions of prostacyclin (epoprostenol) on echocardiographic measures of right ventricular structure and function in primary pulmonary hypertension. *Circulation* 95:1479-86, 1997.
25. Langleben, D., R.J. Barst, D. Badesch, B. Groves, V.F. Tapson, S. Murali, R.C. Bourge, N. Ettinger, E. Shalit, L.M. Clayton, M.M. Jobsis, S.D. Blackburn, **J.W. Crow**, D.J. Stewart, W. Long. Continuous infusion of epoprostenol improves the net balance between pulmonary endothelin clearance and release in primary pulmonary hypertension. *Circulation* 99:3266-71, 1999.
26. Hinderliter, A.L., P.W. Willis, W. Long, W.R. Clark, D. Ralph, E.J. Caldwell, W. Williams, N.A. Ettinger, N.S. Hill, W. R. Summer, B. de Boisblanc, G. Koch, S. Li, L.M. Clayton, M.M. Jobsis, **J.W. Crow**. Frequency and prognostic significance of pericardial effusion in primary pulmonary hypertension. *Am. J. Cardiol.* 84(4):481-4, 1999.
27. Simonneau, G., R.J. Barst, N. Galie, R. Naeije, S. Rich, R.C. Bourge, A. Keogh, R. Oudiz, A. Frost, S.D. Blackburn, **J.W. Crow**, L.J. Rubin, Treprostinil Study Group. Continuous subcutaneous infusion of treprostinil, a prostacyclin analogue, in patients with pulmonary arterial hypertension: A double blind randomized, placebo-controlled trial. *Am. J. Respir. Crit. Care Med.* 165(6):800-4, 2002.

28. Raymond, R.J., A.L. Hinderliter, P.W. Willis, D. Ralph, E.J. Caldwell, W. Williams, N.A. Ettinger, N.S. Hill, W.R. Summer, B. de Boisblanc, T. Schwartz, G. Koch, L.M. Clayton, M.M. Jobsis, **J.W. Crow**, W. Long. Echocardiographic predictors of adverse outcomes in primary pulmonary hypertension. *J. Am. Coll. Cardiol.* 39(7): 1214-9, 2002.
29. Hinderliter, A.L., P.W. Willis, W.A. Long, W.R. Clarke, D. Ralph, E.J. Caldwell, W. Williams, N.A. Ettinger, N.S. Hill, W.R. Summer, B. de Boisblanc, G. Koch, S. Li, L.M. Clayton, M.M. Jobsis, **J.W. Crow**, PPH Study Group. Frequency and severity of tricuspid regurgitation determined by Doppler echocardiography in primary pulmonary hypertension. *Am.J. Cardiol.* 91(8):1033-7, 2003.

Publications: Book Chapters, and Other Articles

1. Long, W.A., C.L. Cooper, W.S. Wheeler, **J.W. Crow**. The potential use of prostacyclin in congestive heart failure. In Rbuayani, G.M. and J.R. Vane (eds), Prostacyclin: New Perspectives for Basic Research and Novel Therapeutic Indications, Elsevier Science Publishers, 1992, pp. 231-246.
2. Cooper C.L., **J.W. Crow**, W.S. Wheeler, W.A. Long. Prostaglandins in congestive heart failure. In Vane, J.R., J. O'Grady (eds), Therapeutic Applications of Prostaglandins, Edward Arnold, London, 1993, pp. 187-197.

Publications: Abstracts

1. Huffman, D.H., **J.W. Crow**, P. Pentikainen and D.L. Azarnoff. Association between clinical cardiac status and digoxin usage. *Clin. Res.* 22:598A, 1974.
2. **Crow, James W.**, D. Shoeman and D.L. Azarnoff. The effects of glutethimide on the performance and pharmacokinetics of smokers and non-smokers. *Fed. Proc.*, 1976.
3. **Crow, James W.**, Milo Gibaldi and Gerhard Levy. Comparative pharmacokinetics of coumarin anticoagulants XLI: Effect of phenobarbital on systemic availability of orally administered dicumarol in rats. *Acad. Pharm. Sci.*, 1978.
4. Zusman, R.M., **J. Crow**, A. Cato, N. Tolkoff-Rubin. Haematologic and haemodynamic effects of prostacyclin in patients with chronic renal failure. *Bulletin European Physiopathologie Respiratoire* 16:1, 1980.
5. Zusman, R. M., N. Tolkoff-Rubin, A. Cato and **J.W. Crow**. Hematologic and hemodynamic effects of prostacyclin in uremia. *Clin. Res.* 28:246A, 1980.
6. Tiedeman, J.S., P.A. Weber, **J.W. Crow**, D.M. Cocchetto, W.A. Harris and M.B Shields. Effect of synthetic cannabinoids on elevated intraocular pressure. *Am. Acad. Ophthal.*, 1980.
7. Zusman, R.M. R.H. Rubin, A. Cato, D. Cocchetto, **J.W. Crow** and N. Tolkoff-Rubin. Prostacyclin can totally replace heparin during hemodialysis: Studies in acute and chronic renal failure. *Clin. Res.* 29:482A, 1981.
8. Cocchetto, D.M., W.A. Wargin, and **J.W. Crow**. Pitfalls and valid approaches to pharmacokinetic analysis of mean concentration data following intravenous administration. *Fed. Proceed.* 40:639, 1981.
9. Smith, M.C., K. Daviriyasup, A.E. Cato, **J.W. Crow** and M.J. Dunn. Prostacyclin (PGI₂) substitution for heparin in hemodialysis. *Kid. Internat.* 19(1):159, 1981.

10. Kuhn, J.G., W.A. Knight, C.B. Griffin, R. Duggan, D.F. Kirksey and **J.W. Crow**. A double-blind crossover trial of anitemetec BW29Y and thiethylperazine. *Drug Intell. Clin. Pharm.* 16:47, 1982.
11. Swartz, R., W. Flamenbaum, **J. Crow**, and A. Cato. Epoprostenol as a substitute for heparin during hemodialysis with high bleeding risk. *ASAIO*, May 1983.
12. Dubrow, A., N. Mittman, **J. Crow**, A. Cato, M. Lifschitz and W. Flamenbaum. Hemodialysis with poprostenol: Safety and efficacy of bicarbonate versus acetate dialysate. *Kid. Internat.* 27:160, 1985.
13. **Crow, J.W.**, A. Dubrow, R. Stewart, A. Cato, W. Flamenbaum and U.S. Prostacyclin Hemodialysis Study Group. Hemorrhage during hemodialysis: Flolan (Prostacyclin) versus heparin. International Conference on Prostaglandins and Related Compounds, Florence, Italy, 1986.
14. Hall, J.C., **J.W. Crow**, A. Cato, M.S. Smith, and D. Clyne,. Med. Col. GA. Augusta, GA. Meeting on the American Society of Nephrology, San Antonio, TX, USA, December 11-14, 1988. *Kid. Int.* 35(1) 242, 1989.
15. Rubin, L.J., M. Thorn, J. Mendoza, M. Hood, R. Barst, M. McGoon, F. Greenstein, W. Long and **J. Crow**. The influence of continuous therapy with intravenous prostacyclin on survival in primary pulmonary hypertension. Seventh International Conference on Prostaglandins and related compounds, Florence, Italy, May, 1990.
16. Long, W., D.S. Terris, D.L. Brown, and **J. Crow**. BW15AU, a stable, orally available prostacyclin analogue, reduces pulmonary vascular resistance in newborn piglets during both hypoxia and hyperoxia. Seventh International Conference of Prostaglandins and Related Compounds. Florence Italy, May, 1990.
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18. Hinderliter, A.L., P.W. Willis, L. Shu, G. Koch, L. Clayton, M. Jobsis and **J.W. Crow**. Pericardial effusion in severe primary pulmonary hypertension. *Am. Heart. Assoc.*, 1995.
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Copyrighted Programs for Computer Assisted Instruction

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2. **Crow, James W.** "Toxicology," Kansas University Medical Center, Department of Pharmacology, 1972.
3. **Crow, James W.** "Hematinics," Kansas University Medical Center, Department of Pharmacology, 1972.
4. **Crow, James W.** "Oral Contraceptives," Kansas University Medical Center, Department of Pharmacology, 1972.
5. **Crow, James W.** "Endocrines," Kansas University Medical Center, Department of Pharmacology, 1972.

6. **Crow James W.** and S.R. Nelson. "Local Anesthetics," Kansas University Medical Center, Department of Pharmacology, 1972.
7. **Crow, James W.** "Autonomics: Synthesis and Biotransformation of Neurotransmitters," Kansas University Medical Center, Department of Pharmacology, 1972.
8. **Crow, James W.** "Autonomics: Mechanisms and Uses," Kansas University Medical Center, Department of Pharmacology, 1972.
9. **Crow, James W.** "Adrenergic Mechanisms and Uses," Kansas University Medical Center, Department of Pharmacology, 1972.
10. **Crow, James W.** "Aspirin-like Analgesics and Anti-inflammatory Agents," Kansas University Medical Center, Department of Pharmacology, 1973.
11. Shoeman, D. and **J.W. Crow.** "An Introduction to Pharmacokinetics," Kansas University Medical Center, Department of Pharmacology, 1973.
12. Uyeki, E. and **J.W. Crow.** "Chemotherapy and Malignant Neoplasms--Some Basic Concepts," Kansas University Medical Center, Department of Pharmacology, 1973.
13. **Crow, James W.** "Chemotherapy and Malignant Neoplasms--Treatment of Selected Disease States," Kansas University Medical Center, Department of Pharmacology, 1973.